May 2, 1961 R. P. SPRIGGS 2,982,356

LOCKING ASSEMBLY

Filed April 13, 1959 2 Sheets-Sheet 1

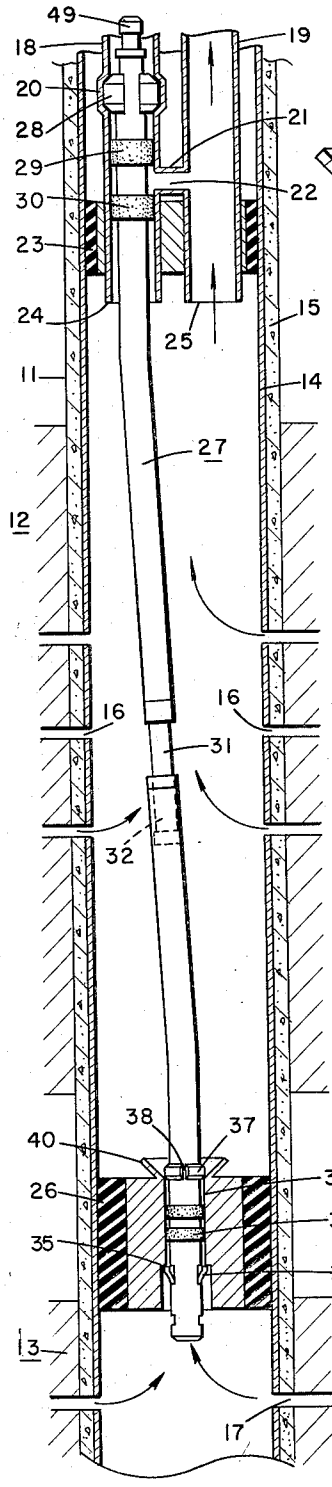


FIG. 1.

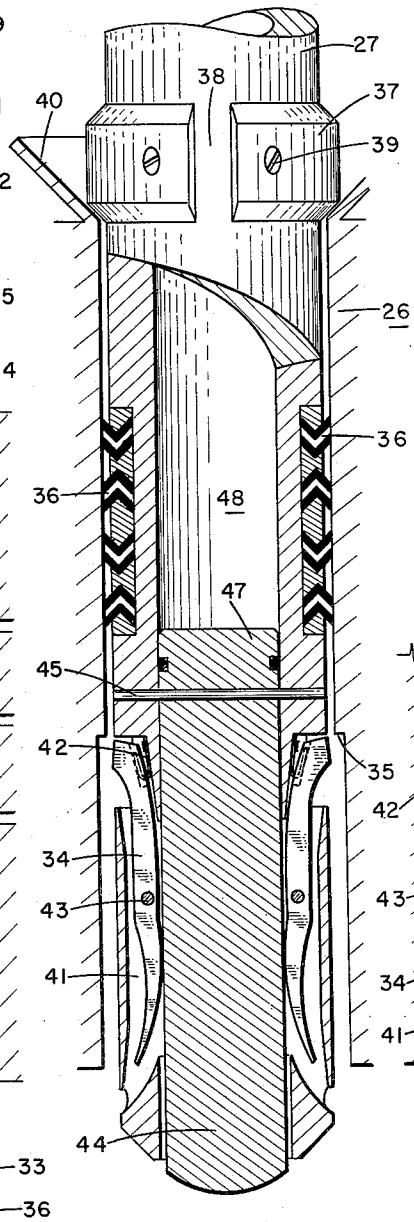


FIG. 2.

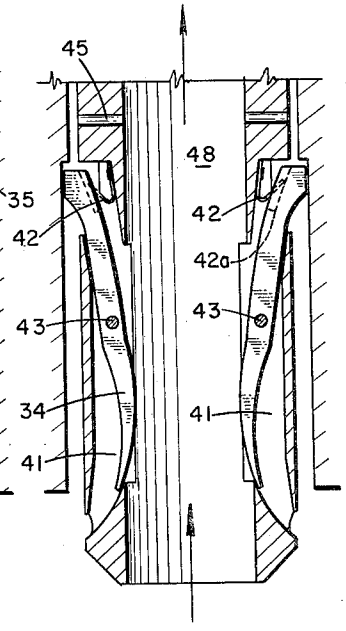


FIG. 3.

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FIG. 4.

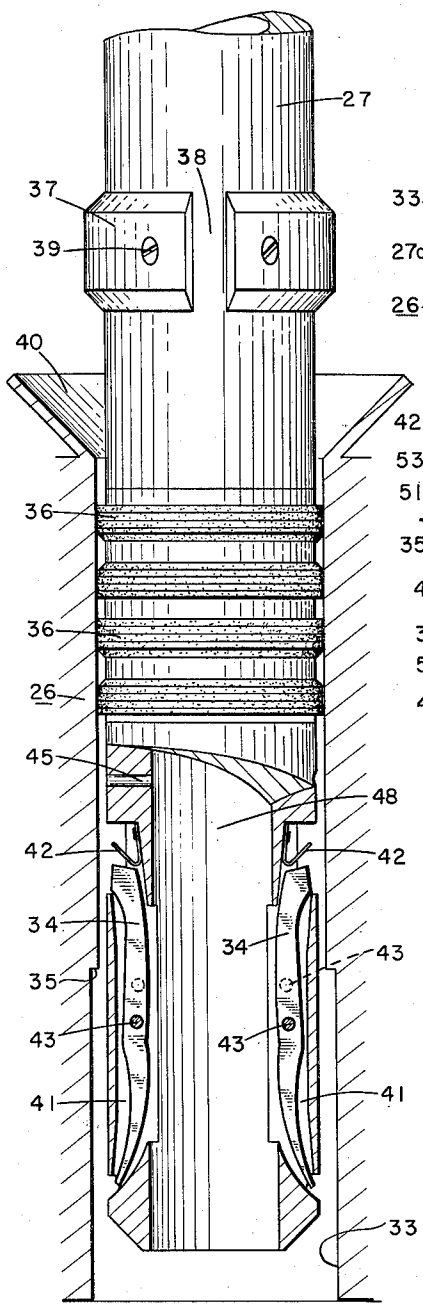


FIG. 5.

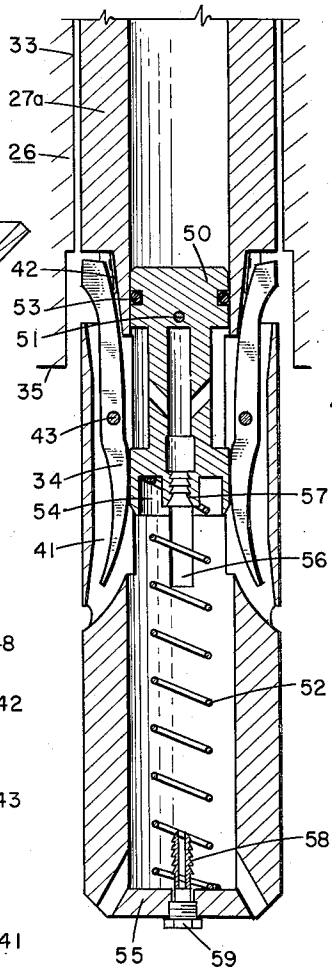
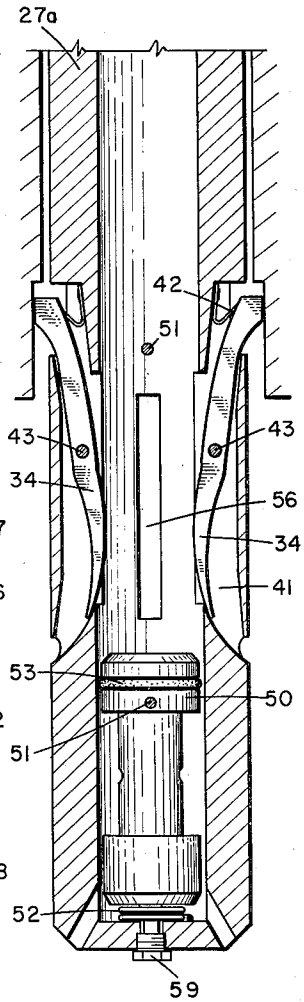


FIG. 6.



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LOCKING ASSEMBLY

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10 Claims. (Cl. 166—114)

The present invention is directed to a locking assembly. More particularly, the invention is concerned with a releasable locking assembly for a retrievable production tube. In its more specific aspects, the invention is concerned with a releasable locking assembly for use in multiple completion of wells in which a packer is spaced below a tubing string to separate one production zone from another.

The present invention will be further illustrated by reference to the drawing in which a preferred embodiment is described in which:

Fig. 1 is a partial sectional view showing the locking assembly arranged in a cased well containing parallel tubing strings;

Fig. 2 is an enlarged partial sectional view of the locking assembly of Fig. 1 in an inoperative position;

Fig. 3 is a partial view of Fig. 2 showing the locking assembly in operative position;

Fig. 4 is a partial sectional view of the device of Figs. 1 to 3 with the pivotal connection broken for releasing the latching dogs and for removal of the assembly;

Fig. 5 is a partial sectional view of a modified device of Figs. 1 to 4 in inoperative position; and

Fig. 6 is a similar view to that of Fig. 5 in operative position.

Referring now to the drawing and particularly to Figs. 1 to 4 in which identical numerals will be employed to designate identical parts, numeral 11 designates a well bore drilled from the earth's surface, not shown, to penetrate hydrocarbon productive zones 12 and 13. Arranged in the well bore 11 is a casing string 14 shown schematically which is cemented in place with cement 15. The casing 14 and cement 15 are perforated in zones 12 and 13 to form perforations 16 and 17 respectively.

Arranged in the well casing 14 and extending to the earth's surface, not shown, are substantially parallel eccentric tubing strings 18 and 19. Tubing string 18 is shown provided with a supporting means such as a landing nipple 20 which may suitably be illustrated by reference to the Composite Catalog of Oil Field Equipment and Services, 22nd edition, page 4151. While the supporting means has been illustrated by a landing nipple, other supporting means may suitably be used. Likewise, while a supporting means 20 is shown in tubing string 18 and none in tubing string 19, it is within the purview of this invention to provide a supporting means similar to 20 in the tubing string 19 if desired.

The tubing strings 18 and 19 are interconnected by a connection means 21 providing a fluid passageway 22. This connecting means, while shown immediately above a packing means 23, may be arranged anywhere within the length of tubing strings 18 and 19. The packing means 23 is suitably a packer such as described in the Composite Catalog supra at page 936.

Spaced below the lower ends 24 and 25 of the tubing strings 18 and 19 and between the zones 12 and 13 is a packer 26 which suitably may be a production packer

illustrated and described at page 590 of the Composite Catalog supra.

Arranged in the supporting means 20 is an elongated tubular member 27 which is latched and anchored by means 28 in the supporting means 20. The tubular member 27 is provided with sealing means 29 and 30 which are spaced apart above and below the passageway 22 to isolate same as may be desired. While the assembly is illustrated with a passageway 22, this may be dispensed with and a single sealing means such as 29 or 30 employed.

The elongated tubular member 27 is provided with a telescoping joint 31 which is shown by dotted lines 32 extending into the lower section of member 27.

In the extended position the tubular member 27 is positioned in the conduit or bore 33 of the packer 26 and is engaged therewith by the latching dogs 34 engaging with the shoulder 35 of the conduit 33. The tubular member 27 is provided with sealing means 36 which suitably may be chevron packing or other sealing means which prevents flow of fluid through the conduit 33 excepting through member 27. Spaced from the latching dogs 34 on the tubular member 27 a distance equal to the disance between the open upper end of the bore 33 and the shoulder 35 is an annular member 37 which suitably may be called a spacing means or a no-go ring. As will be clear from the drawing, shoulder 35 is downwardly facing. This spacing means may be provided with a suitable slot or slots 38 for passage of fluid and may suitably be attached to the tubular member 27 by threaded means 39 as shown more clearly in Fig. 2.

Member 37 serves not only as a spacing or positioning means but also serves to support the lower section of member 27 in conduit 33.

The upper end of the packer 26 may suitably be formed as a guide means 40 which may be a funnel-shaped member to guide the lower end 41 of the tubular member 27 into the conduit 33.

Referring to Figs. 2 and 3 more specifically, it will be seen that the latching dogs 34 are arranged in recesses 41 formed in the wall of the tubular member 27 and are urged outwardly by spring means 42 bearing in recesses 42*a* against the upper end of the latching dogs 34.

The latching dogs 34 are pivotally and releasably attached in the recesses 41 by shear pin pivots 43 which are designed to be ruptured or broken at a certain predetermined and selected tension.

Bearing against the lower end of the latching dogs 34 is a plug means 44 which is held in a first position by a frangible means such as shear pin 45, the plug means 44 being provided with a O-ring or other sealing means 47 for sealingly engaging with the bore 48 of the tubular member 27.

On exerting pressure which may be fluid pressure or pressure imposed by a weight against the plug 44, the shear pin 45 is broken and is forced out of the bore 48 allowing the latching dogs 34 to pivot on shear pins 43 and be urged outwardly from the recess by springs 42 as shown most clearly in Fig. 3 to engage with the shoulder 35.

The embodiment of Figs. 1 to 4 provides a releasable locking assembly and a tubular conduit having an open bore since the plug 44 in moving from its first position to a second position is released from the passageway or bore 48.

When it is desired to retrieve the tubular member 27, which it is noted is sufficiently elongated to extend from the lower end of the tubing 18 through the packer 26, a suitable grab or fishing tool is engaged with the head 49 of the tubular conduit 27 and an upward jar is taken on the tubular member 27 sufficient to rupture the pivot shear pins 43 and cause same to be dropped downwardly

into the recess 41 as shown in Fig. 4. The tubular member 27 is then retrieved through the tubing string 18 by upward pull on a wire line attached thereto.

Referring now to Figs. 5 and 6, a modified embodiment of Figs. 1 to 4 is illustrated. In this particular instance, a modified plug 50 is attached by a shear pin 51 to the inner wall of a modified tubular member 27*a* and is sealed therein by a sealing means such as an O-ring 53 arranged on the plug 50. In this embodiment the latching dogs 34 are identical to the latching dogs 34, Figs. 1 to 4, and the springs 42 are identical to the springs 42 of Figs. 1 to 4.

The plug member is in its first position, where it is held by the shear pin 51. A tension spring 52 having one end attached to the plug member 50 in the recess 54 and its other end attached to plate 55 closing the lower end of the tubular member 27*a* urges the plug member 50 into a second position. The tubular member 27*a* is provided with slots 56 for flow of fluid and the plug member 50 is provided with a latch receiving means 57 containing serrations adapted to engage with a toothed latch 58 which is split for entrance into the latch receiving means 57, the toothed latch 58 being held in the plate 55 by the threaded plug 59.

The device of Figs. 5 and 6 operates similarly to the device of Figs. 1 to 4 in that pressure exerted against the plug 50 causes a rupture of the shear pin 51 and moves the threaded plug from its first releasably attached position to its second position in engagement with the toothed latch 58, the tension spring 52 being collapsed as shown in Fig. 5 and the latching dogs 34 being urged into engagement with the wall of bore 33 below shoulder 35 as shown in Fig. 6.

When it is desired to retrieve the device of Figs. 5 and 6, an upward pull causes the shear pins 43 to be broken and the latching dogs 34 slip downwardly in the recess 41.

The device of the present invention is quite advantageous and useful in the production of petroleum and hydrocarbons from a plurality of zones simultaneously and separately as shown by the arrows indicating flow of fluids. In this invention a positive locking effect is obtained which can only be released on exceeding a predetermined and selected tension on shear pin pivots 43. Thus, the locking assembly on the lower end of the tubular member locks the retrievable tubular member in place for multiple oil or gas well completions. The device is simple in construction, provides a positive lock, and is of such construction that it resists damage thereto during placement operations.

While the device has been illustrated with two locking dogs, any number of locking dogs from one to four may be used satisfactorily. Likewise, while chevron packing and O-rings have been illustrated as the packing means, other packing means may suitably be used.

The operation of the invention and the advantages thereof may be easily understood by the description taken with the drawing.

The nature and objects of the present invention having been described and illustrated, what I wish to claim as new and useful and secure by Letters Patent is:

1. A releasable locking assembly which comprises, in combination, a tubular member, a conduit having an open upper end adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed to provide a recess in its outer wall, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, plug means releasably attached in the bore of said tubular member in a first position and bearing with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, and positioning means carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said positioning means with the open end of said conduit said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said positioning means, release of said plug means by pressure exerted thereagainst moving said plug means from its first position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

2. A releasable locking assembly which comprises, in combination, a tubular member, a conduit having an open upper end adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed to provide a recess in its outer wall, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, plug means in the bore of said tubular member bearing in a first position with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, means releasably attaching said plug means in said bore, and positioning means carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said positioning means with the open end of said conduit said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said positioning means, release of said plug means by pressure exerted thereagainst moving said plug means from its first position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

3. An assembly in accordance with claim 2 in which the plug means is provided with sealing means for sealing between the plug means and the bore of said tubular member and in which the releasable attaching means for the plug means is a shear pin.

4. A releasable locking assembly which comprises, in combination, a tubular member, a conduit having an open upper end adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed to provide a recess in its outer wall, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, plug means releasably attached in the bore of said tubular member in a first position and bearing with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, means carried by said tubular member for sealing with the inner wall of said conduit to prevent flow of fluid through said conduit, and an annular member carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said annular member with the open end of said conduit said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said annular member, release of said plug means by pressure exerted thereagainst moving said plug means

from its first position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

5. A releasable locking assembly which comprises, in combination, a tubular member, a conduit having an open upper end adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed to provide a recess in its outer wall, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, a plug member releasably attached in the bore of said tubular member in a first position and bearing with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, tension means bearing against said plug member and said tubular member normally urging said plug member into a second position, latching means carried by said tubular member for maintaining said plug member in said second position, and positioning means carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said positioning means with the open end of said conduit said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said positioning means, release of said plug member by pressure exerted thereagainst moving said plug member from its first to said second position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

6. A releasable locking assembly for a cased well having a tubing positioned therein, which comprises, in combination, an elongated tubular member, a conduit having an open upper end vertically spaced below said tubing adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed on its first end to provide a recess in its outer wall and being sealingly and releasably attached by its upper end in the lower end of said tubing, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, plug means releasably attached in the bore of said tubular member in a first position and bearing with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, and positioning means carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said positioning means with the open end of said conduit said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said positioning means, release of said plug means by pressure exerted thereagainst moving said plug means from its first position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

7. An assembly in accordance with claim 6 in which the conduit forms the bore of a packer.

8. An assembly in accordance with claim 6 in which the tubular member has a telescoping joint intermediate its ends.

9. A releasable locking assembly which comprises, in combination, a tubular member, a conduit having an open upper end adapted to receive said tubular member and provided with a downwardly facing shoulder on its inner wall, said tubular member being formed to provide a recess in its outer wall, a latching dog pivotally and releasably attached at an intermediate point thereof to said tubular member in said recess, means bearing against said latching dog adjacent one end and spaced from said point normally urging said latching dog out of said recess, plug means in the bore of said tubular member bearing in a first position with its outer surface against said latching dog adjacent its other end and spaced from said point normally urging said latching dog into said recess, means releasably attaching said plug means in said bore, said plug means being provided with sealing means for sealing between the plug means and the bore of said tubular member, means carried by said tubular member for sealing with the inner wall of said conduit to prevent flow of fluid through said conduit, and an annular member carried by said tubular member vertically spaced from said latching dog a distance equal to the distance from the open end of said conduit to said shoulder whereby on reception of said tubular member by and engagement of said annular member with the open end of said conduit, said locking dog is positioned opposite to and in engaging position with said shoulder, said tubular member also being supported in said conduit by said annular member, release of said plug means by pressure exerted thereagainst moving said plug means from its first to a second position whereby said one end of said locking dog is urged into engagement with said shoulder to form a lock therebetween.

10. An assembly in accordance with claim 9 in which the tubular member is provided with means for maintaining said plug means in said tubular member in said second position.

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